BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 13

2003 ANNUAL UPDATE

Shellfish Sanitation Program

Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

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South Carolina Department of Health and Environmental Control

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2003 ANNUAL UPDATE

[Data Thru December 2002]

Shellfish Management Area 13
Shellfish Sanitation Program

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SCDHEC EQC Bureau of Water

Data Inclusive Dates:
01/01/00 thru 12/31/02

Classification Change:
__Yes __X__No

Shoreline Survey Completed: __YES__

(I)ncreased/(D)ecreased/(N)one:
__N__ Approved
__N__ Cond.
__N__ Restricted
__N__ Prohibited

Prior Report & Date: Annual -2002

SUMMARY

The majority of sampling stations in Area 13 showed improvement (lower values) for geometric mean and/or 90th percentile values subsequent to the previous sanitary survey. This appears to be primarily due to the drought conditions the region has experienced over the last four years.

Station 07 in Store Creek meets the criteria for Approved classification, with a 90th percentile of 37MPN. This represents a slight statistical upturn in water quality from the 2002 Annual Update. As this appears to be directly related to the drought conditions, future downward oscillations are likely to occur upon return to normal rainfall patterns. Therefore, the harvesting classification at Station 07 will remain Restricted.

A special study, *"Characterization and Identification of NPS Fecal Coliform Bacteria in Shellfish Growing Areas"* began in January, 2002. The study will attempt to determine the sources of fecal coliform contamination, e.g. human, domesticated animals, wild animals, etc. at selected impaired shellfish waters. Methods used include Multiple Antibiotic Resistance (MAR), typing of F+RNA coliphages (viruses that attack *E.coli*), and typing with ribosomal DNA isolated from the *E.coli*. Portions of Scott, Big Bay, Fishing, Sandy, and Store Creeks and Jeremy and Frampton Inlets were included in the study. A hydrographic dye study of Fishing and Big Bay Creeks was also conducted (see Special Sampling Studies).

Portions of Shellfish Management Area 13 having the most densely human populated areas (i.e., adjacent to Big Bay Creek, Fishing Creek and Store Creek) are adversely impacted by rainfall and resulting runoff. These areas are primarily classified as Restricted. In contrast, the Pine and Otter Islands area stations exhibit little impact from rainfall events and have maintained their Approved status. The majority of Area 13 shellfish resources and associated harvesting activity occurs within this latter portion.

The majority of homes on Edisto Island utilize septic tank systems for wastewater treatment and disposal. Failing septic tanks are potential sources of fecal coliform contamination. Additionally, domestic animals and wildlife are likely contributors of fecal coliform contamination.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47, which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide For The Control Of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey, which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP Guidelines.

Conditionally Approved - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are

predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Conditionally Restricted - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plan for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five

tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Prohibited - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

Shellfish Growing Area 13 consists of approximately 29,643 acres of shellfish growing area habitat located in Colleton and Charleston counties. It is comprised of portions of the South Edisto River and its tributaries including St. Pierre, Big Bay, Scott, Fishing, Sand, Store, Shingle, and Bailey Creeks. The Pine/Otter/South Fenwick Island complex south of Edisto Beach, including Fish Creek and its tributaries is part of the area. Two small inlets and their associated creeks, Jeremy Inlet and Frampton Inlet, are also part of the area.

The area's northern boundary is at Watt's Cut, which is part of the Atlantic Intracoastal Waterway (AICW). The eastern boundary follows S.C. Highway 174 to the point where it crosses Store Creek then is a straight line running southeast to the northern shore of Frampton's Inlet. The southern boundary is the Atlantic Ocean and the mouth of the South Edisto River which runs between Edisto Beach and Pine/Otter Islands. The western boundary is the shoreline of Otter Island and South Fenwick Islands through Fenwick Cut and follows the western shore of the South Edisto River including Alligator Creek ending at Watts Cut. Most of the shellfish resources and harvesting activity is located in the Pine Island/Otter Island area, and in Frampton's Inlet.

The harvesting classifications of Area 13 prior to this survey were as follows:

Prohibited (Administrative closure):

1) Edisto River, from station 20 at Alligator Creek to station 16 at the Highway 174 bridge over North Creek to station 19 at Russell Creek;
2) Big Bay Creek, from its confluence with the South Edisto River at Station 02, to Station 01, Scott Creek at the Mound.

Restricted:

1) Shingle Creek and Milton Creeks from their headwaters to station 28
2) Sandy Creek, from its headwaters to its confluence with Fishing Creek at station 05;
3) Scott Creek, from station 01 at The Mound to Highway 174;
4) Big Bay Creek, from station 01 to station 10 in Fishing Creek;
5) Fishing Creek, from its headwaters to station 04 at Peter's Point;
6) Store Creek, from its headwaters to its confluence with St Pierre Creek;
7) St. Pierre Creek, from station 28 at the confluence of Shingle Creek and Bailey Creek, to station 04, St. Pierre Creek at Peter's Point;
8) Scott Creek from SC Highway 174 to station 23 at Jeremy Inlet;

9) Bailey Creek and tributaries, from its confluence with St. Pierre Creek near station 29, to its confluence with the South Edisto River, at station 31

Approved: The remaining waters of Area 13.

The shellfish industry in South Carolina is based on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams (*Mercenaria mercenaria*). Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State shellfish grounds, culture permits, and Kings Grant areas.

There are five shellfish culture permits in Area 13. Culture permit 157 is leased to the Flowers Oyster Company, 137 to Rodgers/Wannamaker, 138 to Wannamaker, 139 to Baldwin, and 148 to Rodgers/Wannamaker. The general public is allowed to harvest on one State Shellfish Ground in Area 13. Recreational harvesting is allowed for clams and oysters, and commercial harvesting for clams by licensed individuals is currently allowed on the Pine Island State Shellfish Ground (S-140).

Shellfish harvesting season in South Carolina extends from September 16 through May 15, although actual dates may vary. SCDNR has the authority to alter the shellfish harvesting season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that all shellfish harvested in South Carolina waters are safe for human consumption.

POLLUTION SOURCE SURVEY

CHANGES IN POLLUTION SOURCES

Sewer lines have been extended to Neptune and Billow Streets on Edisto Beach to serve condominiums recently built there.

Residential and commercial development is taking place on Edisto Island and Edisto Beach. Bailey Island and adjacent Crawford Island, which are bordered by St. Pierre and Bailey Creeks, will be developed into a total of about 45 lots on a total of approximately 944 acres. This will be a low density development with large lots, and houses on the islands will utilize septic tanks.

SURVEY PROCEDURES

Shoreline surveys of Area 13 were conducted by the Low Country District Shellfish Sanitation staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing.

POINT SOURCE POLLUTION

Major sources of actual or potential pollution (see Figure 4):

PERMITTED FACILITIES	PERMIT # / TYPE / DISCHARGE
Edisto Marina	marina
Edisto Watersports	marina
Edisto Yacht Club	marina
Town of Edisto Beach/Golf Club WWTP	ND0063789- spray irrigation
Jeremy Cay (Edingsville Beach) WWTP	ND0071510- spray irrigation
Hammocks at Jeremy Inlet WWTP	not shown- ND0077534-drip irrigation
Edisto Shrimp Company- Shrimp farm	SC0040401-001, 003, 004, 005- pipes

A. Municipal and Community Waste Treatment Facilities - On Edisto Beach**,** sewer is provided to the Fairfield Ocean Ridge resort and other multiple-unit developments, restaurants, and commercial areas on the beach. Sewer is available to homes along Big Bay Creek.

The Town of Edisto Beach/Edisto Beach Golf Club Inc. wastewater treatment system is located at the end of Holmes Street and serves the Fairfield Ocean Ridge resort community and portions of Edisto Beach. The treatment system consists of aerated lagoons and gas chlorination. The effluent is discharged by spray irrigation to the golf course at Fairfield Ocean Ridge. The facility is permitted to discharge up to 260,000 gallons per day. The permit discharge limits for fecal coliform have been decreased from 200/400 to 14/43 to match the SFH standard of the adjacent water body (Big Bay Creek).

Jeremy Cay at Edingsville Beach has a lagoon and spray field designed to serve up to 42 homes. The Hammocks at Jeremy Inlet has a septic tank and drip irrigation system designed to serve up to 51 homes. The Edistonian General Store's laundromat effluent spray field has been eliminated.

B. Industrial wastes - There are currently no permitted industrial discharges into Area 13.

C. Marinas - S.C. Regulation 61-47, Shellfish defines Marina as "any water area with a structure (docks, basin, floating docks, etc.) which is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space." Three marinas as well as three shrimp boat docks meeting the definition of a marina are located within an extended administratively prohibited closure zone on Big Bay Creek. Edisto Marina and Edisto Water Sports have marine sewage pumpout facilities. The Edisto Island Yacht Club does not. There are numerous private boat docks throughout Area 13.

D. Radionuclides - Sources of radionuclides have not been identified within Area 13, and radionuclide monitoring has not been conducted. No other source of poisonous or deleterious

substances has been identified within the area.

NONPOINT SOURCE POLLUTION

A. **Stormwater** - Stormwater runoff impacts water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area.

On Edisto Beach, stormwater from roads and residences is directed toward Big Bay Creek and Scott Creek. Stormwater from the area south of Lybrand Street is directed toward the golf course lagoons which discharge through pipes at three separate locations into Big Bay Creek. A series of lagoons on the northern end of the beach discharge from a pipe at Whaley Street into an area known as the yacht basin, which is a tributary of Scott Creek. A 30" diameter concrete pipe was recently replaced with a PVC pipe.

On Edisto Island, stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation which is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments which drain into tidal creeks. Four 42-inch culverts were recently placed at four locations where roads cross Cowpens Canal. The canal discharges into the headwaters of Fishing Creek. The purpose of the project is to reduce flooding of roadways. During a shoreline survey, two other drainage ditches were found which also discharge into the headwaters of Fishing Creek. Stormwater discharges appear to be contributing to elevated fecal coliform concentrations at stations 13-09 and 13-12 in Fishing Creek.

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the criteria for permanent water quality ponds having a permanent pool is that they are designed to store the first inch of runoff from the entire site over a 24 -hour period or storage of the first one inch of runoff from the built-upon portion of the property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

B. **Agricultural Waste** - A small herd (approximately 15) of cattle located adjacent to the headwaters area of Sand Creek may be contributing to elevated fecal coliform concentrations at stations 13-05 and 13-05A. A commercial shrimp farm is located near the Highway 174 bridge to the island and discharges water from the ponds into Watts Cut.

C. **Individual Sewage Treatment and Disposal (ISTD) Systems** - Many homes on Edisto Beach and the majority of homes on Edisto Island utilize ISTDs for wastewater treatment and disposal. Interviews with SCDHEC Bureau of Environmental Health indicate that most Edisto Island homes in Area 13 utilize conventional systems, with few modified or ultra-shallow systems in place. The land is relatively high in elevation and drains well. Soils types are Wando, Wagrum, Lakeland, and Charleston. A 50 foot setback from the critical line is required for conventional systems; 150 feet for modified and ultra-shallow.

D. **Wildlife and Domestic Animals** - There are several impoundments along the South Edisto River upstream of Fenwick Cut that are managed for waterfowl. These may impact shellfish waters downstream as water is typically exchanged through tidal action and also when ponds are drained in early spring to allow vegetation to grow.

This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife, which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats.

E. **Boat Traffic** - The South Edisto River inlet provides ocean access for many recreational and commercial vessels. Additionally, the Atlantic Intracoastal Waterway (AIWW) is located in the South Edisto River between Fenwick Cut and Watts Cut. Tugs and barges, commercial and recreational vessels utilize this North/South route.

F. **Hydrographic and Habitat Modification** - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. Portions of the AIWW require maintenance dredging. The U.S. Army Corps of Engineers utilizes designated tracts of land

adjacent to the AIWW as dredge spoil sites.

A bike path was recently installed on the causeway connecting Edisto Beach to Edisto Island. This earthen causeway crosses the headwaters of Scott Creek. At one time a 40-foot bridge crossed over this tidal creek. In 1939 the causeway was filled in and the road was paved, essentially damming the headwaters. Some local citizens are concerned that this constriction of tidal flow is in part the cause of silting and water quality problems in Scott Creek and have been investigating replacing the causeway with a bridge.

G. Marine Biotoxins - There have been no documented occurrences of toxic algae affecting water quality in Area 13. The Department participates in a State Task Force on Toxic Algae and maintains a toxic algae emergency response team.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

Area 13 is part of the St. Helena Sound estuary which is a drowned river valley/bar built system containing numerous marsh islands and tidal creeks. It is among the largest of the South Atlantic estuaries. The average depth of the estuary is approximately 12 feet at mid-tide level. A natural channel exists in the lower South Edisto River. Extensive shallow areas and numerous tidal flats exist within the estuary. The AIWW (12 feet at MLW) is the only maintained navigational channel (NOAA, 1994).

Tides - Tides in Area 13 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range at the mouth of the South Edisto River is 5.9 feet during normal tides and 6.9 feet during spring tides. The highest tidal ranges of the year occur from September through December. There is considerable variation in the normal tide range due to the prevailing strength and direction of winds.

Rainfall - Rainfall data used in this survey is collected at a weather station (382730-Edisto Island 3 SW) located at the Edisto Beach State Park. The rainfall gauge is typically read at about 8:00 AM and the rainfall amount is recorded for that date. As most shellfish samples are collected after 8:00 AM, the rainfall for the sample date + 24 hours has been added to the rainfall summary table. Rainfall for the sample date + 24 hours may correlate better and help to explain elevated fecal coliform concentrations in sample results, particularly if there was zero rainfall on the date of or prior to sampling.

Annual rainfall is normally about 49.31", with August (7.46") being the wettest month. A chart showing yearly rainfall amounts for the years 1997 through 2002 is attached. Approximately 40% of the annual rainfall falls in the three-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and shower activity of short duration. The months of July, August, and September also have the greatest numbers of days with rainfall exceeding 1.00". The months of December through March historically have the greatest number of days with rainfall exceeding

0.10" and 0.50". Rainfall events during these months are typically of a longer duration.

The effects of El Niño were first experienced as early as March of 1997, in the form of decreased rainfall. Rainfall amounts were below normal until mid-summer when the warm phase El Niño effects were observed in the form of above normal rainfall. The full influence of El Niño with regard to rainfall was observed in the fall of 1997 and the spring of 1998, when amounts were recorded in excess of the 30 year average. This "warm and wet" trend continued through April, 1998. The 102 year (1895-1996) El Niño average rainfall for November to March for this region of S.C. is about 125% of the normal rainfall amount. The region has experienced drought conditions for the last four years.

Winds - The prevailing wind direction between February and September ranges between South and South Southwest (180 to 200 degrees) and between October and January is North Northeast (20 degrees). The annual mean wind speed is 8.5 MPH, with August having the lowest (7.3 MPH) and March the highest (10.0 MPH) mean wind speed.

River discharges - The South Edisto River originates in the midlands of South Carolina and flows approximately 140 miles through the piedmont and coastal plain until it enters the Atlantic Ocean at Edisto Beach. The river discharges at an average rate of 2631 cubic feet per second. There is significant impact from freshwater inflow, in the form of low salinities and high fecal coliform concentrations, to stations 16 through 20 in Watts Cut and the South Edisto River, particularly in the winter and spring.

An attempt was made to correlate elevated fecal coliform levels at stations 08, 17, and 20 with the river stage. There were no apparent correlations in the data used. This is likely due to the distance between the shellfish monitoring stations and the gauging station. The gauging station is located at river mile 59.9 at the Highway 61 bridge in Dorchester County.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 13 in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays, and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July, 1998, an updated data analysis procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36 month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples

per station yet provides a six sample "cushion" (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

Six hundred seventy-two (672) routine surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses at 22 active water quality sampling stations in Area 13 during the period 01/01/00 through 12/31/02.

The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control's Trident District Environmental Quality Control laboratory at North Charleston, South Carolina or the Low Country District laboratory in Beaufort, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control > 10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined using Nautical Software's *Tides and Currents*, Version 2 (1996).

In the 2001 sanitary survey, Shingle Creek and Milton Creek, from their headwaters to station 06, were classified as Restricted. Station 06 was deactivated and a new station, 28 has been established at the confluence of Shingle and Milton Creeks to better assess water quality in this area. Bailey Creek, from its confluence with St. Pierre Creek near station 06, to its confluence with South Edisto River was classified as Restricted. Three new stations have been added in Bailey Creek. Station 29 is near the confluence with St. Pierre Creek; station 30 is at the confluence of Bailey Creek and the unnamed tributary at the Southwestern point of Scanawah Island; and station 31 is at the confluence of Bailey Creek and the South Edisto River. A new sampling station, 27, was added in Frampton's Inlet. Stations 05A, 09, and 12 were deactivated, as historically these stations have met the criteria for a Restricted classification. Station 14 was also deactivated, as it has historically met the criteria for an Approved classification. There are a sufficient number of stations located nearby to station 14 to adequately evaluate water quality.

SPECIAL SAMPLING STUDIES

A special study, *"Characterization and Identification of NPS Fecal Coliform Bacteria in Shellfish Growing Areas"* began in January, 2002. The study will attempt to determine the sources of fecal coliform contamination, e.g. human, domesticated animals, wild animals, etc. at selected impaired shellfish waters. Methods used include Multiple Antibiotic Resistance (MAR), typing of F+RNA coliphages (viruses that attack *E.coli*), and typing with ribosomal DNA isolated from the *E.coli*. Portions of Scott, Big Bay, Fishing, Sandy, and Store Creeks and Jeremy and Frampton Inlets were

included in the study.

The study also included a hydrographic dye survey of Fishing and Big Bay Creeks on May 1-2, 2002. Tracer dye was injected shortly after high tide into Fishing Creek approximately halfway between stations 13-09 and 13-10. The results indicate that the majority of the dye stayed in Fishing Creek and that the dye would reach St. Pierre Creek, near station 13-04, on one (ebb) tide cycle. Dye injected into Big Bay Creek just upstream of the confluence with Scott Creek (near station 13-01) during flood tide was found to reach a point about halfway between stations 13-21 and 13-10. The results of the dye study will be used to determine if specific fecal coliform sources are impacting specific shellfish monitoring stations.

MONITORING RESULTS

Stations 2, 3, 4, 7, 8, 13, 14, 15, 20, 21, 24, 25, and 26 did not exceed a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43 and therefore meet the statistical criteria for an Approved classification. Stations 1, 5, 10, 22, and 23 exceeded a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43, thus meeting the statistical criteria for a Restricted classification. Stations 27, 28, 29, 30, and 31 are new stations with 12 sample results for the review period. A minimum of 30 sample results is required to classify these stations.

CONCLUSIONS

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 13 is impacted by three sources of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in the developed portions of Area 13. The impact of rainfall on water quality in tidal creeks in the developed areas is greater than that in the undeveloped areas such as Pine and Otter Islands. Individual rainfall events have more effect than freshwater inflow on water quality at stations in tidal creeks and the two inlet areas in Area 13. Possible sources of fecal coliform bacteria contamination include drainage ditches, freshwater wetlands, failing septic systems, pets, domestic animals (dogs, cats, horses, and cows), wildlife, and boats.

Area 13 tidal creeks are shallow, so that the volume of water necessary to dilute fecal coliform bacteria concentrations down to Approved levels is simply not there. In addition, there is very little shellfish resource present in the Restricted areas to facilitate filtering bacteria out of the water.

FRESHWATER INFLOW

Portions of Area 13 receive appreciable freshwater inflow from the South Edisto River,

particularly between January and April. The impact is typically confined to those stations (8 and 20) located in the South Edisto River. There is a direct relationship between lower salinity and elevated fecal coliform bacteria concentrations. This was particularly evident during the El Niño event between November, 1997 and April, 1998 when the area received abnormally high rainfall. Salinity of zero parts per thousand (ppt) was recorded at station 20. Lower salinity and elevated bacteria concentrations also occur following significant rainfall events (>3.00 inches) and in samples collected at low tide. There are also freshwater wetlands on Edisto Island that drain through ditches into tidal creeks.

INDIVIDUAL SEWAGE TREATMENT AND DISPOSAL SYSTEMS

Soils in most areas of Edisto Island are considered to be suitable for ISTDs. However, there are many older homes with "grandfathered" systems which may not meet current standards. In some areas, erosion of creek banks may have reduced the setback from tile fields and problems related to the density of homes on septic systems may be contributing to elevated fecal coliform bacteria concentrations.

RECOMMENDATIONS

Station 13-07 in Store Creek does not exceed the statistical criteria for Approved classification, with a 90th percentile MPN of 37 However, the current water quality classification appears to be a direct result of severe drought conditions, and will likely revert to a Restricted classification once normal rainfall patterns return. Therefore, it is recommended that the harvesting classification of Store Creek remain Restricted.

The shoreline survey and bacteriological data review of shellfish Management Area 13 indicates that no changes in classification boundary descriptions are necessary. Harvesting waters classifications of Area 13 will be as follows (see Figure 3):

Prohibited (Administrative closure):

1) Edisto River, from station 20 at Alligator Creek to station 16 at the Highway 174 bridge over North Creek to station 19 at Russell Creek;
2) Big Bay Creek, from its confluence with the South Edisto River at Station 02, to Station 01, Scott Creek at the Mound.

Restricted:

1) Shingle Creek and Milton Creeks from their headwaters to station 28
2) Sandy Creek, from its headwaters to its confluence with Fishing Creek at station 05;
3) Scott Creek, from station 01 at The Mound to Highway 174;
4) Big Bay Creek, from station 01 to station 10 in Fishing Creek;
5) Fishing Creek, from its headwaters to station 04 at Peter's Point;
6) Store Creek, from its headwaters to its confluence with St Pierre Creek;
7) St. Pierre Creek, from station 28 at the confluence of Shingle Creek and Bailey Creek, to station 04, St. Pierre Creek at Peter's Point;

8) Scott Creek from SC Highway 174 to station 23 at Jeremy Inlet;

9) Bailey Creek and tributaries, from its confluence with St. Pierre Creek near station 29, to its confluence with the South Edisto River, at station 31

Approved: The remaining waters of Area 13.

Station Addition/Deactivation/Modification: None

Analysis of sampling data for Area 13 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of area 13 will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured at the Edisto Island 3-SW Weather Stations. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). PMP estimates for the coastal United States have been published in a series of hydro-meteorological reports (HMRs) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*).

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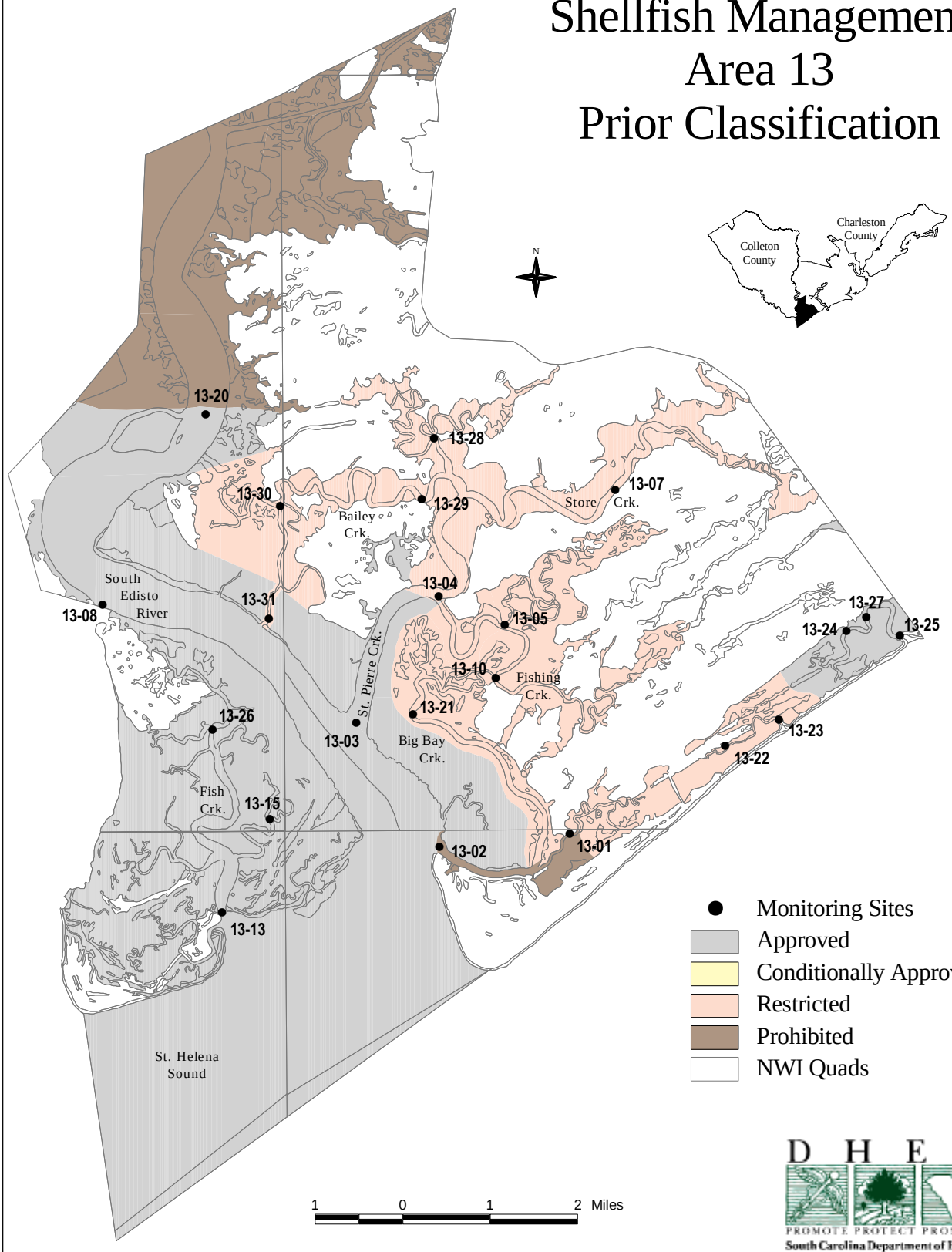
TABLE #1
Shellfish Management Area 13
WATER QUALITY SAMPLING STATION DESCRIPTIONS

Station	Description
01	Scott Creek at The Mound
02	Mouth of Big Bay Creek
03	Mouth of St. Pierre Creek
04	St. Pierre Creek at Peters Point.
05	Fishing Creek at Sandy Creek
07	Store creek opposite house with docks on right
08	Edisto River at Ashepoo River
10	Fishing Creek at Pollution Line
13	Mouth of Fish Creek at Otter Island and Atlantic Ocean
15	Headwaters of Pine Island Creek at the fork
20	Northern confluence of Alligator Creek and S. Edisto River
21	Big Bay Creek headwaters at first bend to right past the Neck
22	Headwaters of Scott Creek at Jeremy Inlet at the boat landing
23	Jeremy Inlet at Atlantic Ocean
24	Frampton inlet at north end of Jeremy Cay
25	Frampton Inlet at Atlantic Ocean
26	4,000ft From the Confluence of Fish Creek and Atlantic Ocean at First "T" in Fish Creek
27	Frampton Inlet creek upstream of boat ramp past first bend
28	Confluence of Shingle Creek and Bailey Creek
29	Bailey Creek, first bend adjacent to bluff on Bailey Island (near confluence with St. Pierre Creek)
30	Bailey Creek at confluence with unnamed tributary near Southwestern point of Scanawah Island
31	Bailey Creek at confluence with South Edisto River

(Total 22 Active)

Figure 1.
Shellfish Management Area 13 Prior Classification



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2003 Annual Report

Figure 2.
Shellfish Management Area 13 Current Classification

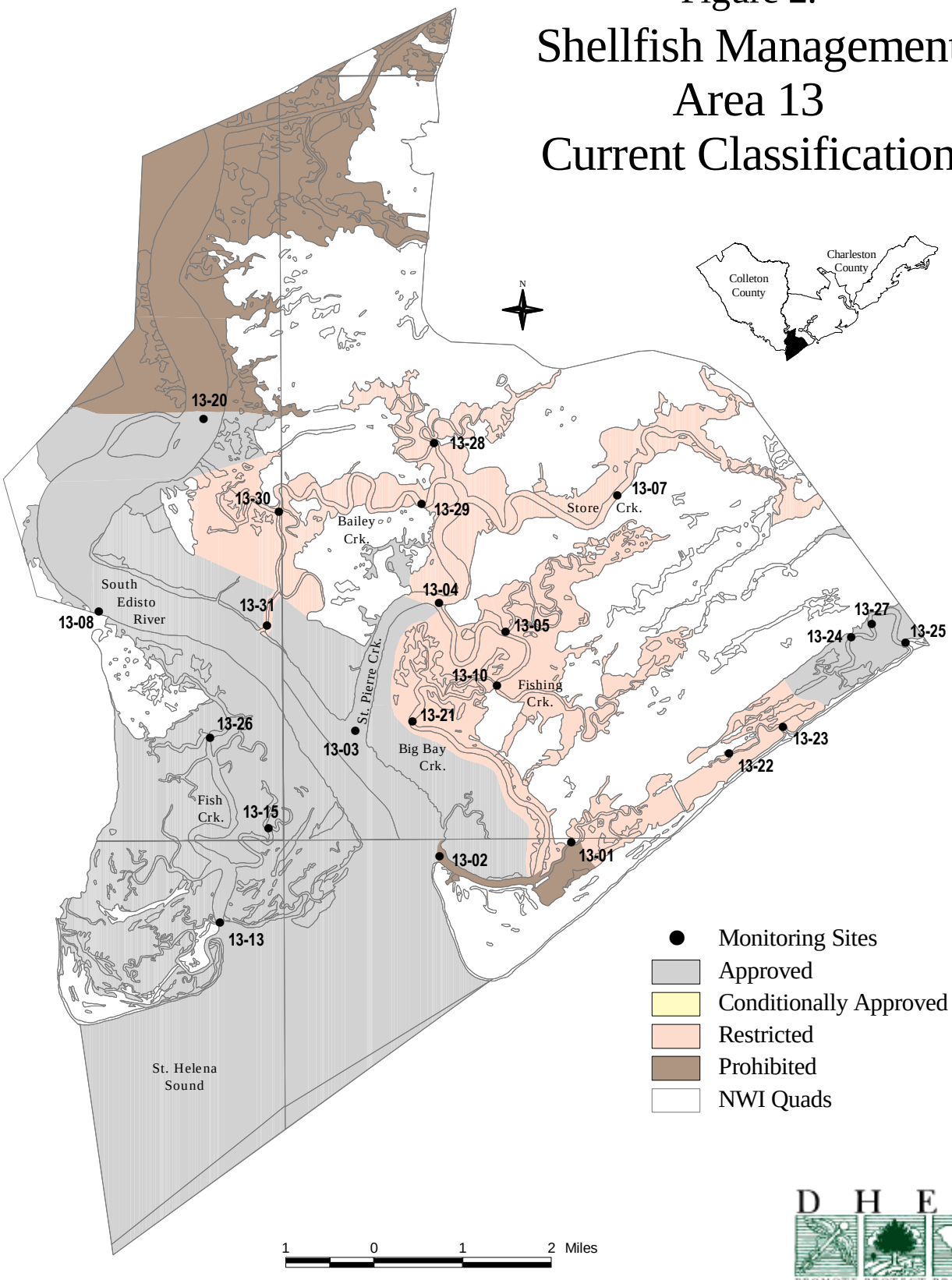

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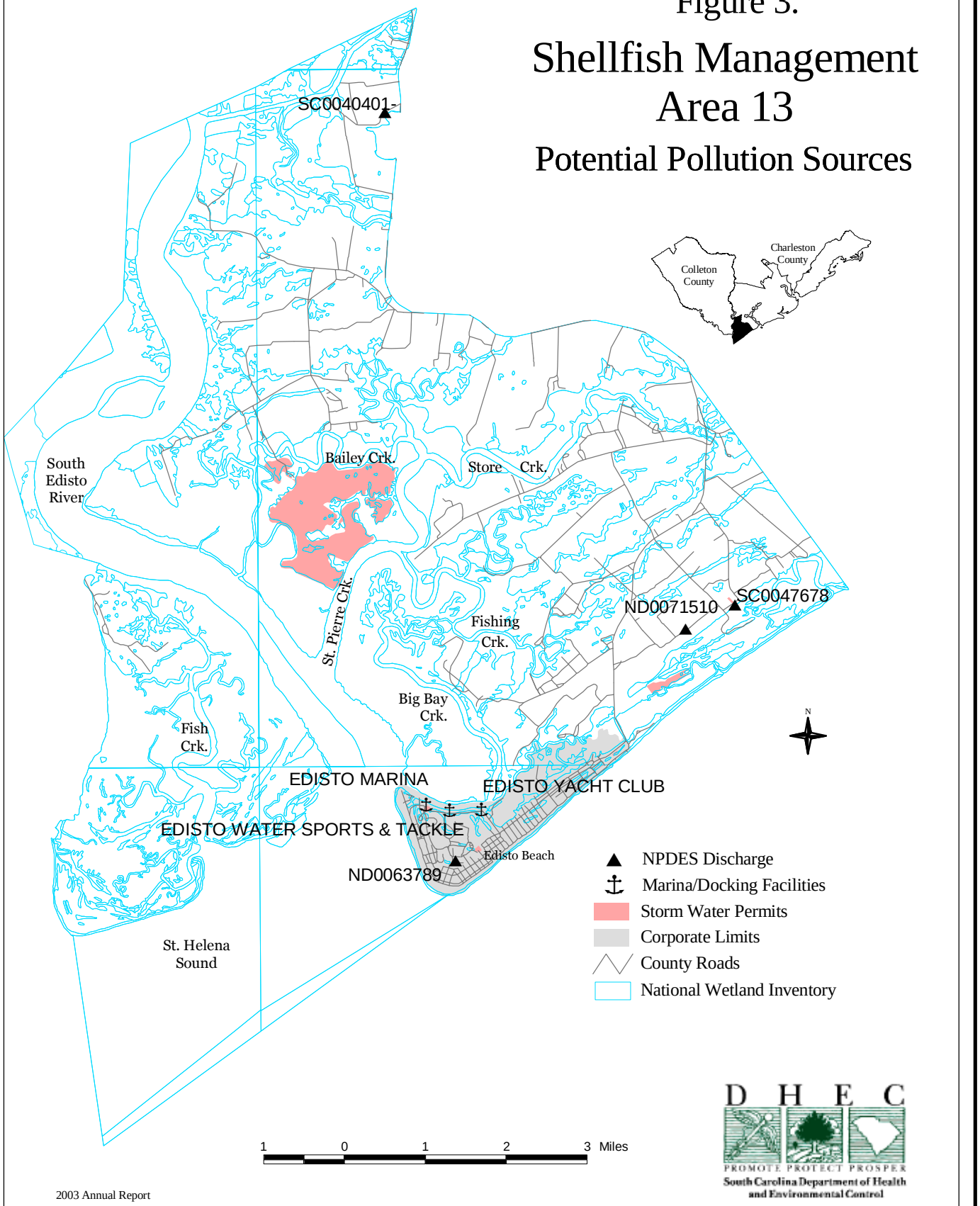
Figure 3.

Shellfish Management Area 13

Potential Pollution Sources



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South Carolina Department of Health and Environmental Control

TABLE #2
Shellfish Management Area 13

FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Shellfish Water Quality Sampling Stations between
January 1, 2000 & December 31, 2002

Station #	1	2	3	4	5	7	8	10	13	15
SAMPLES	36	36	36	36	36	36	36	36	36	36
GEOMEAN	7.4	4.4	5.2	5.5	14.7	11.0	5.1	16.1	2.3	2.9
90TH %ILE	45	27	26	22	74	37	26	69	5	6
WATER QLTY	R	A	A	A	R	A	A	R	A	A
CLASSIFICATION	P	P	A	R	R	R	A	R	A	A

Station #	20	21	22	23	24	25	26	27	28	29
Samples	36	36	36	36	35	35	36	12	12	12
GeoMean	6.4	6.3	11.5	10.0	6.7	4.9	3.1	7.5	23.2	17.3
90th %ile	31	26	126	100	27	16	10	26	100	171
Water Qlty	A	A	R	R	A	A	A	New	New	New
Classification	P	R	R	R	A	A	A	New	New	New

Station #	30	31								
Samples	12	12								
GeoMean	29.7	8.0								
90th %ile	188	121								
Water Qlty	New	New								
Classification	New	New								

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** - Prohibited

TABLE #3

Water Quality
Sampling Stations Data

Shellfish Management Area 13

BACTERIOLOGICAL DATA

Data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control - Freedom of Information office at the address below.

Freedom of Information
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE #4

Rainfall Data

Shellfish Management Area 13

SOURCE:
Rainfall information provided by
Edisto Island Rainfall Station 382730

A SUMMARY OF RAINFALL
During and Prior To Fecal Coliform Sampling

Sample Date	Date+24 hrs	Date	Date -24 hrs	Date -48 hrs	Date -72 hrs
01/11/00	0.00"	0.00"	0.29"	0.00"	0.00"
02/01/00	0.00"	0.00"	0.00"	0.43"	0.25"
03/15/00	0.45"	0.00"	0.00"	0.00"	0.00"
04/19/00	0.00"	0.00"	0.00"	0.00"	0.00"
05/08/00	0.00"	0.00"	0.00"	0.00"	0.00"
06/05/00	0.00"	0.33"	0.38"	0.00"	0.00"
07/19/00	0.00"	0.00"	0.00"	0.00"	0.00"
08/21/00	no data	0.00"	no data	0.25"	0.00"
09/25/00	0.00"	0.92"	0.00"	0.35"	0.02"
10/03/00	0.00"	0.00"	0.00"	0.00"	0.00"
11/06/00	0.10"	0.35"	0.01"	0.00"	0.00"
12/12/00	0.00"	0.00"	0.00"	0.60"	0.00"
01/17/01	0.10"	0.00"	0.00"	0.00"	0.15"
02/13/01	0.00"	0.00"	0.00"	0.53"	0.10"
03/21/01	0.00"	1.20"	0.52"	0.00"	0.00"
04/02/01	0.00"	0.00"	0.00"	0.00"	0.00"
05/22/01	0.00"	1.35"	0.00"	0.00"	0.00"
06/13/01	0.10"	no data	0.00"	0.10"	0.51"
07/11/01	0.22"	no data	no data	no data	no data
08/27/01	0.00"	0.00"	0.00"	0.00"	0.00"
09/18/01	0.00"	0.00"	0.00"	0.00"	0.00"
10/16/01	0.00"	0.00"	0.00"	0.45"	0.00"
11/06/01	0.00"	0.00"	0.00"	0.00"	0.00"
12/17/01	0.00"	0.00"	0.00"	0.00"	0.00"
01/09/02	0.00”	0.00”	0.00”	0.00”	0.00”
02/04/02	0.01”	0.00”	0.00”	0.00”	0.00”
03/12/02	0.00”	0.25”	0.00”	0.00”	0.00”
04/15/02	0.00”	0.00”	0.00”	0.00”	0.03”
05/06/02	0.00”	0.00”	0.20”	0.00”	0.00”
06/03/02	0.00”	0.00”	0.00”	0.00”	0.00”
07/01/02	0.00”	0.00”	0.00”	0.00”	0.00”
08/02/02	0.00”	0.00”	0.08”	0.00”	0.00”
09/24/02	1.77”	0.17”	0.02”	0.28”	0.00”
10/01/02	0.00”	0.00”	0.00”	0.00”	no data
11/17/02	0.00”	0.00”	0.84”	0.00”	0.00”
12/15/02	0.00”	0.00”	0.00”	0.34”	0.73”

[Amounts Shown Are per Day, not Cumulative] Station 382730 - Edisto Island- 3 – SW

ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: South Carolina State Climatology Office

Columbia, SC (Edisto Island - Station #382730 / 3-SW)

2000	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.16	0.00	0.00	0.00
2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.14	0.00	0.00	0.10
3rd	0.00	0.00	1.10	0.00	0.00	0.00	0.00	--	2.25	0.00	0.00	0.00
4th	0.00	0.00	0.02	0.00	0.00	0.38	0.00	0.12	1.27	0.06	0.01	0.00
5th	0.02	0.00	0.00	0.00	0.00	0.33	0.00	1.70	1.13	0.00	0.35	0.00
6th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.10	0.00
7th	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.02	0.00
8th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.60
10th	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
11th	0.00	0.00	0.05	0.00	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00
12th	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.32	0.00	0.00	0.00	0.00
13th	0.00	1.50	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.08	0.00
14th	0.00	0.47	0.00	0.53	0.00	0.00	--	0.24	0.00	0.00	0.00	0.10
15th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
16th	0.06	0.00	0.45	0.00	0.00	0.00	0.00	--	0.00	0.00	0.42	0.10
17th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.39	0.00
18th	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.10	0.00	0.73	0.00
19th	0.23	0.00	2.40	0.00	0.00	0.83	0.00	--	0.00	0.00	0.00	0.10
20th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
21st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.02	0.00	0.00	0.00
22nd	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.25	0.35	0.00	0.00	0.00
23rd	0.25	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.38	0.00
24th	0.36	0.00	0.00	0.35	0.00	0.00	1.30	0.00	0.92	0.00	0.43	0.00
25th	0.02	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00
26th	0.00	0.10	0.00	0.00	0.14	0.00	--	0.27	0.00	0.00	0.00	0.00
27th	0.00	0.00	0.15	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00	0.19
28th	0.47	0.00	0.00	0.00	0.51	0.10	--	0.00	0.00	0.00	0.00	1.17
29th	0.25	0.00	0.00	0.38	0.00	0.00	--	0.15	0.00	0.00	0.00	0.00
30th	0.43		0.26	0.00	0.00	0.00	1.95		0.00	0.00	0.00	0.00
31st	0.00		0.00		0.00		--			0.00		0.00
(Monthly Figures)							**Year's Rainfall Total:**				**33.80**	
SUM	2.43	2.07	4.43	1.26	0.65	1.64	4.03	3.32	8.61	0.06	2.91	2.39
MAX	0.47	1.50	2.40	0.53	0.51	0.83	1.95	1.70	2.25	0.06	0.73	1.17
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.08	0.07	0.14	0.04	0.02	0.05	0.17	0.15	0.29	0.00	0.10	0.08

Note:"--" denotes missing data

(Shellfish Management Areas 12A, 12B, 13)

ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: South Carolina State Climatology Office

Columbia, SC (Edisto Island - Station #382730 / 3-SW)

2001	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.02	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00
2nd	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	1.61	0.00	0.00	0.00
3rd	0.00	0.10	0.36	0.00	0.00	0.73	--	0.00	0.62	0.00	0.00	0.00
4th	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	0.02	0.00	0.00	0.00
5th	0.00	0.00	0.00	0.00	0.00	0.00	--	0.12	0.25	0.00	0.00	0.00
6th	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.01	0.00	0.00
7th	0.05	0.00	0.00	0.00	0.03	0.71	--	0.00	0.00	0.00	0.00	0.00
8th	0.16	0.00	0.00	0.00	0.00	0.10	--	0.00	0.03	0.00	0.00	0.39
9th	0.00	0.00	0.00	0.00	0.00	0.25	--	0.05	0.00	0.00	0.00	0.00
10th	0.00	0.10	0.00	0.00	0.00	0.51	--	0.00	0.00	0.00	--	1.77
11th	0.12	0.53	0.00	0.00	0.00	0.10	--	0.00	0.00	0.00	0.00	0.00
12th	0.00	0.00	0.85	0.00	0.03	0.00	0.22	0.00	0.00	0.00	0.00	0.05
13th	0.00	0.00	0.00	0.10	0.00	--	0.15	0.43	0.35	0.00	0.00	0.10
14th	0.15	0.00	0.17	0.00	0.00	0.10	0.00	0.15	0.25	0.45	0.00	0.00
15th	0.00	0.00	0.62	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16th	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18th	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00
19th	0.22	0.00	0.52	0.00	0.00	0.08	0.00	0.22	0.00	0.00	0.00	0.00
20th	0.00	0.00	1.20	0.00	0.00	0.20	2.00	1.78	0.25	0.00	0.00	0.00
21st	0.00	0.13	0.00	0.00	0.00	0.25	0.10	0.18	0.00	0.00	0.00	0.00
22nd	0.42	0.00	0.00	0.00	1.35	0.05	0.00	0.00	0.00	0.00	0.00	0.00
23rd	0.00	0.00	0.00	0.00	0.00	--	0.46	0.00	0.01	0.00	0.00	0.00
24th	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00	0.65	0.00	0.34	0.00
25th	0.00	0.32	0.09	0.35	0.00	--	0.00	0.00	0.02	0.00	0.00	0.00
26th	0.00	0.00	0.00	0.00	0.50	--	0.00	0.00	0.00	0.00	0.00	0.00
27th	0.00	0.04	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.00
28th	0.00	0.00	0.22	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
29th	0.00		0.20	0.00	0.00	0.00	--	0.00	0.00	--	0.00	0.00
30th	0.13		0.00	0.00	0.00	0.00	1.15	--	0.00	0.00	0.00	0.00
31st	0.00		0.00		0.00		0.00	1.55		0.00		0.00
(Monthly Figures)							**Year's Rainfall Total:**				**31.08**	
SUM	1.35	1.39	4.30	0.57	1.91	3.08	5.58	5.73	4.06	0.46	0.34	2.31
MAX	0.42	0.53	1.20	0.35	1.35	0.73	2.00	1.78	1.61	0.45	0.34	1.77
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.04	0.05	0.14	0.02	0.06	0.12	0.29	0.19	0.14	0.02	0.01	0.07

Note:"--" denotes missing data

(Shellfish Management Areas 12A, 12B, 13)

ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: South Carolina State Climatology Office

Columbia, SC (Edisto Island - Station #382730 / 3-SW)

2002	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.08	0.05	0.00	0.00	0.00
2nd	0.40	0.00	1.75	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00
3rd	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00	--	0.10	0.00
5th	0.00	0.01	0.00	0.00	0.20	0.00	0.10	0.00	0.00	--	0.68	0.00
6th	0.00	1.25	0.00	0.00	0.00	0.00	0.15	0.17	0.00	0.00	0.00	0.00
7th	0.00	0.30	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00
8th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00
9th	0.00	0.13	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.12	1.23
10th	0.00	0.27	0.00	0.75	0.00	--	0.00	0.00	0.00	6.35	1.14	0.18
11th	0.50	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.20	0.70	0.00
12th	0.95	0.00	0.25	0.03	0.00	0.00	0.00	0.00	0.00	0.00	--	0.73
13th	0.00	0.00	0.00	0.00	0.06	--	0.70	0.00	0.00	0.00	1.12	0.34
14th	0.37	--	0.00	0.00	0.00	0.00	0.00	0.10	0.33	1.74	0.00	0.00
15th	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00	1.03	0.10	0.00	0.00
16th	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.84	0.00
17th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00
18th	0.00	0.00	0.00	0.00	1.29	0.40	0.00	0.00	0.00	0.00	0.00	0.57
19th	0.07	0.00	--	0.00	0.37	--	0.00	0.00	0.00	0.00	0.00	0.11
20th	0.00	0.25	--	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00
21st	0.00	0.00	0.42	0.00	0.00	0.95	0.00	0.00	0.00	0.09	0.00	0.00
22nd	0.00	0.10	0.00	0.00	0.00	1.90	0.50	0.00	0.28	0.00	0.00	0.00
23rd	0.15	0.00	0.00	0.00	0.00	0.82	0.20	0.00	0.02	0.02	0.00	0.00
24th	0.10	0.00	0.00	0.00	0.00	1.75	0.00	0.95	0.17	0.12	0.00	1.19
25th	0.22	0.00	0.00	0.00	0.00	1.35	0.00	1.75	1.77	0.00	0.00	0.00
26th	0.04	0.08	0.17	0.10	0.00	0.15	0.00	0.63	0.00	--	0.00	0.00
27th	0.00	0.00	0.00	--	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00
28th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00
29th	0.00		0.00	0.00	0.00	0.00	0.00	1.78	0.13	1.59	0.00	0.00
30th	0.00		0.00	0.00	0.00	0.00	0.00	1.05	0.00	0.00	0.00	0.00
31st	0.00		0.56		0.00		0.22	0.55		--		0.00
(Monthly Figures)							**Year's Rainfall Total:**				**58.35**	
SUM	2.80	2.49	3.71	1.13	1.92	9.88	2.25	9.66	4.68	10.78	4.70	4.35
MAX	0.95	1.25	1.75	0.75	1.29	1.90	0.70	1.78	1.77	6.35	1.14	1.23
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.09	0.09	0.13	0.04	0.06	0.37	0.07	0.31	0.16	0.40	0.17	0.14

Note:"--" denotes missing data

(Shellfish Management Areas 12A, 12B, 13)